

## CLAIMS

1. A method of producing a solid electrolyte comprising:

preparing solid electrolyte material with a composition expressed by a formula:

(1-x)  $\text{ZrO}_2$  + x $\text{Sc}_2\text{O}_3$  (where x is a number equal to or greater than 0.05 and equal  
5 to or less than 0.15); and

sintering the solid electrolyte material to obtain a solid electrolyte using a spark  
plasma method, which is provided with:

sintering the solid electrolyte material to obtain sintered material while  
applying first compression load to the solid electrolyte material at a level equal to  
10 or less than 40 MPa; and

cooling the sintered material to obtain the solid electrolyte while applying  
second compression load, less than the first compression load, to the sintered  
material.

2. The method according to claim 1, wherein the second compression load has a  
15 value equal to or greater than 10 MPa and equal to or less than 15 MPa.

3. The method according to claim 1, wherein the solid electrolyte material is  
sintered at a temperature equal to or greater than 1000 °C and equal to or less  
than 1150 °C for time equal to or greater than 30 minutes and equal to or less  
than 180 minutes.

20 4. The method according to claim 1, wherein the solid electrolyte material is  
sintered by rising a temperature at a temperature rising speed equal to or greater  
than 250 °C/minute.

5. The method according to claim 1, wherein after sintering the solid electrolyte  
material, the solid electrolyte material is cooled by dropping a temperature at a  
25 temperature drop speed equal to or less than 200 °C/minute.

6. The method according to claim 1, wherein the solid electrolyte material is  
comprised with powder of citric acid salt.

7. The method according to claim 1, wherein the solid electrolyte material is  
calcined and pulverized prior to sintering.

30 8. The method according to claim 1, wherein the solid electrolyte material is

formed in a compact while being sintered.

9. The method according to claim 1, wherein after the solid electrolyte material is sintered, heat-treatment is conducted at a temperature equal to or greater than 900 °C and equal to or less than 1000 °C for time equal to or greater than 5  
5 hours and equal to or less than 15 hours.

10. The method according to claim 1, wherein suppose that an X-ray diffraction intensity is I, the solid electrolyte has a cubic-crystal ratio,  $[I (\text{cubic crystal: 220}) / \{I (\text{cubic crystal: 220}) + I (\beta\text{-phase: 220})\}] \times 100 (\%)$ , equal to or greater than 90 %.

10 11. The method according to claim 1, wherein the solid electrolyte has a mean grain diameter equal to or less than 3 $\mu\text{m}$ .

12. A solid electrolyte obtained by a spark plasma method and a composition expressed by a formula:  $(1-x) \text{ZrO}_2 + x\text{Sc}_2\text{O}_3$  (where x is a number equal to or greater than 0.05 and equal to or less than 0.15) wherein suppose that an X-ray  
15 diffraction intensity is I, the solid electrolyte has a cubic crystal ratio,  $[I (\text{cubic crystal: 220}) / \{I (\text{cubic crystal: 220}) + I (\beta\text{-phase: 220})\}] \times 100 (\%)$ , equal to or greater than 90 %.